



# Federal Aviation Administration

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## Memorandum

Date: January 4, 2011

To: Manager, Seattle Aircraft Certification Office, ANM-100S

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Sue McCormick

Subject: INFORMATION: Equivalent Level of Safety Finding for the Boeing Model 787 Series Aircraft Fuselage Associated to Post-Crash Fire Survivability (FAA Project No. TC6918SE-T)

ELOS Memo #: TC6918SE-T-CS-14

Reg. Ref.: §§ 25.853, 25.856(b), and 21.21(b)(1)

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The purpose of this memorandum is to inform the certificate management aircraft certification office of an evaluation made by the Transport Airplane Directorate (TAD) on the establishment of an equivalent level of safety (ELOS) finding for the Boeing Model 787 series aircraft.

### Background

A number of large transport aircraft accidents have occurred in which spilled jet fuel ignited and the ensuing fires have penetrated the fuselage structure, ignited the interior, and caused numerous fatalities. The FAA has conducted an extensive program of large-scale fire tests to evaluate existing large transport aircraft designs and determine how these designs and the usage of existing interior materials could affect occupant survivability in a post-crash external fuel-fed fire. These tests led to adoption of a requirement for the fire penetration resistance of thermal acoustic insulation, installed in the lower half of the fuselage.

Survivable accidents have indicated that the integrity of the aircraft and its ability to provide a barrier against external fire penetration is an important factor related to the survival of aircraft occupants, using conventional airframe construction. That is, extending an occupant's ability to survive in a post-crash environment could be achieved by fire hardening the hull to limit fire transmission through the structure and prevent structural collapse in critical areas.

To simplify the certification of the new and improved insulation materials installed in traditional aluminum fuselages, the test method defined in Title 14 Code of Federal Regulations (14 CFR) 25.856(b) and part VII of appendix F was developed to realistically simulate the thermal characteristics of a post-crash fire in a small-scale test environment. In this test method, the aircraft skin is not represented because its contribution to the delay of an external fuel-fed fire is well known, based on large-scale tests and accident data of the existing fleet, and its performance is not directly related to the performance of the insulation system. The test method is intended to measure the fire penetration performance of the insulation system itself and not a representative fuselage burnthrough condition, or an overall assessment of post crash fire survivability.

Boeing proposed an ELOS to § 25.856(b) be obtained by demonstrating that the Model 787 series maintains a post-crash fire survivability period of five minutes, by performing a large-scale or laboratory-scale test to show the acceptability of the Model 787 series in a post-crash jet fuel pool fire.

#### **Applicable regulation(s)**

§§ 21.21(b)(1), 25.853 and 25.856(b)

#### **Regulation(s) requiring an ELOS finding**

§ 25.856(b), part VII of appendix F to part 25

#### **Description of compensating design features or alternative standards which allow the granting of the ELOS (including design changes, limitations or equipment need for equivalency)**

The FAA has determined that an ELOS finding per § 21.21(b)(1) may be granted for the requirements of § 25.856(b), Amendment 25-111, provided the applicable large-scale certification or laboratory-scale testing shows the Model 787 series composite fuselage skin and associated structural/system components provide a survivable cabin environment for five minutes or equivalent to a traditional aluminum fuselage with compliant insulation.

#### **Explanation of how design features or alternative standards provide an equivalent level of safety to the level of safety intended by the regulation**

Section 25.856(b) requires for airplanes with a passenger capacity of 20 or greater, thermal/acoustic insulation materials (including the means of fastening the materials to the fuselage) installed in the lower half of the airplane fuselage must meet the flame penetration requirements of part VII of Appendix F to this part, or other approved equivalent test requirements. The intent of the improved thermal/acoustic insulation materials and installations is to extend the survivability within the cabin by delaying the entry of a post-crash fire and the resulting flashover condition, which is the critical factor affecting occupant survivability based on numerous large-scale tests performed by the FAA. The all-composite fuselage must be examined from a post-crash survivability standpoint because of the possibility that other

parameters, such as smoke or toxic gas emissions, could have a significant impact on survivability. Based on service experience and tests, traditional aluminum fuselage materials and insulation systems have not detrimentally affected the survivability within the cabin by emitting any of these toxins.

#### **FAA approval and documentation of the ELOS finding**

The FAA has approved the aforementioned ELOS finding in project Issue Paper CS-14. This memorandum provides standardized documentation of the ELOS that is non-proprietary and can be made available to the public. The TAD has assigned a unique ELOS memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS memorandum number should be listed in the type certificate data sheet under the certification basis section. An example of an appropriate statement is provided below.

Equivalent Safety Findings have been made for the following regulation(s):  
 § 25.856(b) (documented in TAD ELOS Memo TD6918SE-T-CS-14)

*for Franklin Thompson*  
 Manager, Transport Airplane Directorate,  
 Aircraft Certification Service

*1/13/11*  
 Date

ELOS Originated by Seattle ACO:	Project Engineer Sue McCormick	Routing Symbol ANM-150S
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